SECTION 02300 - EARTHWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Related Sections include the following:

1. Division 1 Section "Temporary Facilities and Controls" for temporary controls, utilities, and support facilities.
2. Divisions 1 Section 01521, “Construction Safety and Occupational Health” for construction safety requirements.
3. Division 3 Section "Cast-in-Place Concrete" for granular course if placed over vapor retarder and beneath the slab-on-grade.
4. Divisions 2, 15, and 16 Sections for installing underground mechanical and electrical utilities and buried mechanical and electrical structures.

C. Reference Standards include, but are not limited to:
1. American Society of Testing and Materials (ASTM) – latest edition:
   a. D 422 Method for Particle Size Analysis of Soils
   b. D 698 Test for Moisture-Density Relations of Soils – Standard Proctor Method
   c. D 1556 Field In-Place Density Tests using Sand Cones
   d. D 2167 Test for Density of Soil In-Place by Rubber Balloon Method
   e. D 2216 Laboratory Determination of Moisture Content of Soil
   f. D 2487 Classification of Soils for Engineering Purposes
   g. D 2922 Test for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
   h. D 2937 Test for Density of Soil In Place by Drive Cylinder Method
   i. D 3017 Test for Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
   j. D 4318 Test for Plastic Limit, Liquid Limit, and Plasticity Index of Soils
2. American Association of State Highway and Transportation Officials (AASTHO) – latest edition
   a. T 88 Mechanical Analysis of Soils

1.2 SUMMARY

A. This Section includes the following:

1. Preparing subgrades; including but not limited to scarifying, compaction, moisture content control, and removal of unsuitable materials; for slabs-on-grade, walks, pavements, lawns and grasses and exterior plants.
2. Excavating, proofrolling, and backfilling for buildings and structures.
3. Drainage course for slabs-on-grade.

4. Subbase course for concrete walks and pavements.
5. Subsurface drainage backfill for walls and trenches.
6. Excavating and backfilling for utility trenches.
7. Excavating and backfilling trenches for buried mechanical and electrical utilities and pits for buried utility structures.

1.3 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.

C. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

D. Drainage Course: Course supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

E. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Bulk Excavation: Excavation more than 3 m in width and more than 9 m in length.
2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

F. Fill: Soil materials used to raise existing grades.

G. General Fill: Fill placed at a depth greater than 1.5 m below final grade in areas that are not within the footprint of a structure.

H. On-site Soil: Soil excavated from other portions of the site.

I. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 0.76 cu. m for bulk excavation or 0.57 cu. m for footing, trench, and pit excavation that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:

1. Excavation of Footings, Trenches, and Pits: Late-model, track-mounted hydraulic excavator; equipped with a 1065-mm- wide, maximum, short-tip-radius rock bucket; rated at not less than 103-kW flywheel power with bucket-curling force of not less than 125 kN and stick-crowd force of not less than 83 kN; measured according to SAE J-1179.
2. Bulk Excavation: Late-model, track-mounted loader; rated at not less than 157-kW flywheel power and developing a minimum of 216-kN breakout force with a general-purpose bare bucket; measured according to SAE J-732.

J. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

K. Subbase Course: Course placed between the subgrade and base course for hot-mix asphalt pavement, or course placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

L. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

M. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.4 SUBMITTALS

A. All submittals shall be in accordance with Specification Section 01331 “Construction Submittals”.

B. Prior to mobilization, the Contractor shall submit a schedule detailing the proposed sequence and time of completion of all phases of work under this section. The schedule shall include a list of types and sizes of equipment that will be used to perform the work specified herein.

C. Prior to using imported fill, the Contractor shall submit the following laboratory test data for each type of imported soil/gravel material to be used as compacted fill:
1. Moisture and Density Relationship: ASTM D698
2. Mechanical Analysis: AASTHO T-88
3. Plastic Index: ASTM D 4318
4. Relative Density: ASTM D 2049

D. Blasting Plan: Prior to using any type of blasting or explosives, the Contractor shall submit a detailed blast plan. The plan shall include but not be limited to sizes and types of charges, proposed blasting patterns, public safety protection plan and schedule.

E. As-built drawings as well as records of any as-built variation from the construction plans and specifications shall be submitted by the Contractor upon completion of the work.

1.5 QUALITY ASSURANCE

A. The Contractor shall provide at least one supervisory person who shall be present at all times during execution of the work and who is thoroughly familiar with the type of work being performed and its best methods for completion. This person shall have the authority act on behalf of the Contractor.

B. The Contractor shall comply with any provisions of all applicable codes, regulations, and standards.

C. A Geotechnical Engineer should be retained to perform construction inspection on site based on density testing, visual observation, and judgment. This inspection will not relieve the

Contractor from his responsibility to complete the work in accordance with the plans and specifications.

D. Visual field confirmation and density testing of subgrade preparation and fill placement procedures shall be performed by the Geotechnical Engineer as part of the construction testing requirements.

E. The Geotechnical Engineer shall prepare field reports that indicate compaction test location, elevation data, testing results and acceptability. Copies of the reports shall be submitted within 96 hours of time test was taken.

F. All costs related to reinspection due to failures shall be paid by the Contractor at no additional expense. Contractor shall provide free access to site for inspection activities.

G. Geotechnical Testing Agency shall be an independent testing agency qualified according to ASTM E 329 to conduct soil materials and rock-definition testing, as documented according to ASTM D 3740 and ASTM E 548.

H. A preexcavation conference shall be conducted at the Project site to comply with requirements in Division 1 Section "Project Coordination."

1.6 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by the Government or others unless permitted in writing by Government and then only after arranging to provide temporary utility services according to requirements indicated.
   1. Notify the Government not less than two days in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without the Government's written permission.

B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with local utility companies to shut off services if lines are active.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Onsite material may be used as fill if it meets the requirements for the material at each location. Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: ASTM D 2487 Soil Classification Groups GW, GP, GM, SW, SP, ML, CL, SM, SC, and some MH and CH soils as limited below or a combination of these groups; free of rock or gravel larger than 150 mm in any dimension, debris, waste, vegetation, and other deleterious matter.
   1. For fill beneath structures and all fill within 1.5 m of final grade, satisfactory soils shall have a liquid limit less than 50% as defined by ASTM D4318.

2. For general fill, satisfactory soils shall have a liquid limit less than 60% and a plasticity index less than 30% as defined by ASTM D4318
3. Unsuitable soils are satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

C. Unsatisfactory Soils: Soil Classification Groups GC, OL, OH, and PT according to ASTM D 2487, or a combination of these groups.

D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 37.5-mm sieve, 70 percent passing a 9.5 mm sieve, 30 percent passing a 2.0 mm sieve and not more than 12 percent passing a 0.075-mm sieve.

E. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 25-mm sieve and not more than 8 percent passing a 0.075-mm sieve.

F. Drainage Course: Narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 37.5-mm sieve and 0 to 5 percent passing a 2.36-mm sieve.

G. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 25-mm sieve and 0 to 5 percent passing a 4.75-mm sieve.

H. Sand: ASTM C 33; fine aggregate, natural, or manufactured sand.

I. Rock may be broken and/or crushed on –site to meet the above size requirements.

2.2 GEOTEXTILES

A. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability: Class 2; AASHTO M 288.
2. Grab Tensile Strength: 1100 N; ASTM D 4632.
3. Sewn Seam Strength: 990 N; ASTM D 4632.
4. Tear Strength: 400 N; ASTM D 4533.
5. Puncture Strength: 400 N; ASTM D 4833.
6. Apparent Opening Size: 0.250-mm sieve, maximum; ASTM D 4751.
7. Permittivity: 0.02 per second, minimum; ASTM D 4491.
8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

2.3 EQUIPMENT

A. Sheepsfoot Roller: General Compactor: Minimum 5-ton static sheepsfooted compactor.

B. Smooth Drum Roller: – Minimum 5 ton static smooth drummed roller.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to all work of this section, the Contractor shall become thoroughly familiar with the geotechnical engineering study as well as the site, site conditions, and all portions of the work within this section.

3.2 PREPARATION

A. The Contractor shall refer to the soil erosion and sediment control drawings for staging of earthwork operations and for erosion control measures to be implemented prior to commencement of earthwork. Protect and maintain erosion and sedimentation controls, which are specified on the drawings.

B. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, vehicle traffic, and other hazards created by earthwork operations.

C. Notify local utility companies to allow removal and/or relocation of any utilities that are in conflict with the proposed improvements.

D. Protect benchmarks, property corners and all other survey monuments from damage or displacement. If a marker needs to be removed/relocated it shall be referenced by a licensed land surveyor and replaced, as necessary, by the same at no additional cost.

E. Remove from the site, material encountered in grading operations that, in opinion of Government or the Geotechnical Engineer, is unsuitable or undesirable for fill or backfill as per Section 2.1.C.

F. Preparation of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface to the satisfaction of the Geotechnical Engineer.

G. Protect persons and property from damage and discomfort caused by dust. Water as necessary to quell dust.

H. Shoring, bracing, and fencing shall be installed in accordance with Specification Section 01141, Construction Safety, as well as the requirements of all Government Authorities having jurisdiction.

I. Protection of Existing Trees: Specifically the large sized Panama located to the immediate north and east of the roadway culvert is to be protected throughout the course of construction. See drawing C1.84 for exact location. See Drawing C1.84 for exact location. The Contractor shall preserve the existing trees and shrubbery to the greatest extent possible.

J. Access is not permitted through the preserve area except at the location of the new roadway.

3.3 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
2. Install a dewatering system as required to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

3.4 EXPLOSIVES

A. Explosives may be required for bulk excavation of rock. The blasting contractor should be cautioned that this site is in a residential area. A blasting plan must be submitted as described in Part 1 of this specification.

3.5 GENERAL

A. Identify required lines, levels, contours and datum to bring site grades to the proposed subgrade conditions inferred from the drawings.

B. Do not allow or cause any of the work performed or installed to be covered by work of this section prior to all inspections, tests and approvals.

C. By submitting his bid, the Contractor represents that he has reviewed the information provided and investigated the site to determine type, quantity, quality, and character of excavation work to be performed. All excavation shall be considered unclassified excavation.

D. Perform excavation using capable, well maintained equipment and methods acceptable to the Government.

E. When performing grading operations during periods of prolonged wet or dry weather, provide adequate measures for surface drainage and ground water control, and moisture control of soils (i.e., wetting or drying by discing) so as to place and compact the soil within the moisture content range a few percentage points of its optimum water content. Any disturbed areas should be proofrolled at the end of each day. Only minimum work should be performed in periods of heavy rain.

F. All underground installation of pipes, conduit, etc. in the area to be paved shall be completed prior to placement of any asphalt or concrete paving.

G. Allow no debris to accumulate on-site. Haul debris away from the site and dispose of at no cost to the Government.

H. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials. High plasticity soils (MH and CH) should be separated from satisfactory soils that will be placed in areas beneath structures or within 1.5 m of final subgrade.

I. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:
   1. 600 mm outside of concrete forms other than at footings.
   2. 300 mm outside of concrete forms at footings.
   3. 150 mm outside of minimum required dimensions of concrete cast against grade.
   4. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
   5. 150 mm beneath bottom of concrete slabs on grade.
   6. 150 mm beneath pipe in trenches, and the greater of 600 mm wider than pipe or 1065 mm wide.

3.6 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 25 mm. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

   1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work. If entire footing is not to be poured immediately, a thin layer of concrete shall be poured to protect approved foundation soils.
   2. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 25 mm. Do not disturb bottom of excavations intended as bearing surfaces.

3.7 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.8 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

   1. Beyond building perimeter, excavate trenches to allow installation of top of pipe at proper grade. The following minimum pipe installation depths shall be met:
      a. Water Mains: 900 mm to top of pipe barrel.
      b. Sanitary Sewer: Elevations, and grades as indicated on Drawings.
      c. Storm Sewer: Elevations, and grades as shown on Drawings.
      d. Electrical Duct Banks: 600 mm, or as required by the International Electric Code (IEC).

e. Telephone Conduits: 450 mm minimum to top of conduit, or as required by the local utility company, whichever is deeper.

2. Utility alignments have been designed to avoid unexpected obstructions wherever possible. If unanticipated obstructions are encountered during utility installation, immediately notify the Government.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 300 mm higher than top of pipe or conduit, unless otherwise indicated.

1. Clearance: 300 mm each side of pipe or conduit.

C. Trench Bottoms: Excavate trenches 100 mm deeper than bottom of pipe elevation to allow for bedding course. Hand excavate for bell of pipe.

1. Excavate trenches 150 mm deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

D. During excavation, excavated material shall be stockpiled in an orderly manner, far enough away from the trench to avoid overloading, slides or cave-ins

3.9 SUBGRADE PREPARATION

A. Notify the Geotechnical Engineer when excavations have reached required subgrade.

B. If the Geotechnical Engineer determines that unsatisfactory soil is present, continue excavation and replace with concrete, compacted backfill, or fill material as directed.

C. Scarify the top 150 mm and thoroughly proof the entire exposed ground surface following clearing. Proof roll final subgrade below building slabs and pavements with a minimum of 6 passes of the smooth drum roller identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 5 km/h.
2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by The Geotechnical Engineer, and replace with compacted backfill or fill as directed.

D. Reconstruct subgrades damaged by temperatures, frost, rain, accumulated water, or construction activities, as directed by The Geotechnical Engineer, without additional compensation.

E. Prior to preparing the subgrade in low lying areas, perform the following procedures:

1. Drain standing water by gravity or with a pump. Drainage using wells/well points may be required where the water table is high. Water should not be discharged directly to a storm drain system.

2. After drainage of low area is complete, remove mulch, mud, debris, and other unsuitable material using equipment and methods that will minimize disturbance to the underlying soils.
3. Thoroughly compact subgrade as specified in Section 3.016.
4. If proposed for fill, all muck, mud and other materials removed from above low areas shall be dried on-site by spreading in thin layers for observation by the Government or the Government's representative. Material shall be inspected and, if found to be suitable for use as fill material, shall be incorporated into lowest elevation of site filling operation, but not under the building area, within 8 m of the perimeter of the building, or within 1 m of the paving subgrade elevation. If, after observation by Government or the Government's representative, material is found to be unsuitable, it shall be removed from the site at no cost to the Government.

3.10 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 17.2 MPa, may be used when approved by the Geotechnical Engineer.

1. Fill unauthorized excavations under other construction or utility pipe as directed by the Geotechnical Engineer.

3.11 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust and to protect from rain water.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.12 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
2. Surveying locations of underground utilities for Record Documents.
3. Testing and inspecting underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring and bracing, and sheeting.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

C. Compaction of backfill should be with a sheepsfoot roller.

3.13 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Backfill trenches excavated under footings and within 450 mm of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Division 3 Section "Cast-in-Place Concrete."

D. Provide 100-mm- thick, concrete-base slab support for piping or conduit less than 750 mm below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 100 mm of concrete before backfilling or placing roadway subbase.

E. Backfill voids with satisfactory soil while installing and removing any shoring and bracing.

F. Place and compact final backfill of satisfactory soil to final subgrade elevation. Exercise proper caution when compacting immediately over top of pipes or conduits.

G. Install warning tape directly above utilities as required, 300 mm below finished grade, except 150 mm below subgrade under pavements and slabs.

3.14 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material; general fill can be used at depths greater than 1.5 m below final subgrade.
2. Under walks and pavements, use satisfactory soil material.

C. Place soil fill on subgrades free of mud.

D. Soil fill for embankments shall be placed in compacted tiered lifts. Thickness of individual lifts should not exceed 500 mm.

3.15 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 3 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy.
2. Remove and replace, or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content by 3 percent and is too wet to compact to specified dry unit weight.

3.16 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 200 mm compacted depth for material compacted by heavy compaction equipment, and not more than 100 mm compacted depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:

1. Under structures, building slabs, steps, and pavements, scarify and recompact top 500 mm of existing subgrade and each layer of backfill or fill soil material at 98 percent.
2. Under walkways, scarify and recompact top 150 mm below subgrade and compact each layer of backfill or fill soil material at 95 percent.
3. Under lawn or unpaved areas, scarify and recompact top 150 mm below subgrade and compact each layer of backfill or fill soil material at 93 percent.
4. For utility trenches, compact each layer of initial and final backfill soil material at 95 percent.

3.17 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Lawn or Unpaved Areas: Plus or minus 25 mm.
2. Walks: Plus or minus 25 mm.
3. Pavements: Plus or minus 13 mm.

C. Grading inside Building Lines: Finish subgrade to a tolerance of 13 mm when tested with a 3-m straightedge.

3.18 SUBBASE AND BASE COURSES

A. Place subbase and base course on subgrades free of mud.

B. On prepared subgrade, place subbase and base course under pavements and walks as follows:

1. Shape subbase and base course to required crown elevations and cross-slope grades.
2. Place subbase and base course 150 mm or less in compacted thickness in a single layer.

3. Place subbase and base course that exceeds 150 mm in compacted thickness in layers of equal thickness, with no compacted layer more than 150 mm thick or less than 75 mm thick.
4. Compact subbase and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 98 percent of maximum dry unit weight according to ASTM D 698.

3.19 DRAINAGE COURSE

A. Place drainage course on subgrades free of mud.

B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:

1. Place drainage course 150 mm or less in compacted thickness in a single layer.
2. Place drainage course that exceeds 150 mm in compacted thickness in layers of equal thickness, with no compacted layer more than 150 mm thick or less than 75 mm thick.
3. Compact each layer of drainage course to required cross sections and thicknesses to not less than 98 percent of maximum dry unit weight according to ASTM D 698.

3.20 FIELD QUALITY CONTROL

A. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.

B. Footing Subgrade: The Geotechnical Engineer shall inspect foundation excavations to confirm that soils exposed are as anticipated by the designers. Such inspection may include proofrolling as described in Section 3.9, shallow borings (2 to 3 meters), dynamic cone penetration tests, or other tests to confirm that foundation soils are undisturbed and that soil composition and consistency is similar to that encountered in the geotechnical borings.

C. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least 1 test for every 186 sq. m or less of paved area or building slab, but in no case fewer than 3 tests.
2. Foundation Wall Backfill: At each compacted backfill layer, at least 1 test for each 100 30 m or less of wall length, but no fewer than 2 tests.
3. Trench Backfill: At each compacted initial and final backfill layer, at least 1 test for each 46 m or less of trench length, but no fewer than 2 tests.
4. In all other areas, quality control tests should be performed on every other compacted lift, a minimum of 2 tests per 400 sq. m of fill. This testing frequency may be adjusted at the discretion of the Geotechnical Engineer providing controlled inspection of the backfilling.

D. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

3.21 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.22 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION 02300